

Vulnerable populations in the Arctic

Earth's average surface temperature is rising unusually fast. This global warming process is deemed by international scientific assessment to be predominantly due to human economic activities (1). Recent research indicates that, globally, the rate of emission of greenhouse gases is increasing (2), as is the rise in sea level and the loss of summer Arctic sea ice (3). Currently, the warming trend is 'tracking' at the top of the range of the previously modelled forecasts (4). Meanwhile, concerns are growing that, as higher temperatures are reached, reinforcing ('positive') feedback systems in nature will accelerate the process.

The warming is occurring more rapidly in the higher latitudes of the northern hemisphere than in the rest of the globe. Already, since mid-twentieth century, an increase of 1–2°C have occurred within the Arctic region. By later this century, for 'medium' global emissions scenarios, the temperature increase in the Arctic is likely to be in the range of plus 4–7°C, approximately double the global average warming. Such a rise, occurring so rapidly, would place extraordinary stress on ecosystems and would disrupt many geophysical processes (including precipitation patterns, ice cover, river flows and ocean currents).

Indeed, various ecosystems are already being influenced by the warming. In consequence, and more generally, life in the high-latitude north for all living beings is beginning to be affected by the direct and indirect effects of climate change. However, so far, research into the impacts of climate change has paid little attention to the risks to human health. Instead, concerns have been focused on the consequences for economic conditions, the vulnerability of industries and effects on ecosystems 'out there' – including iconic species and assets for tourism. There is urgent need to recognise that, in addition – and of particular concern – human health, both physical and mental, will be affected by climate change. Those human health impacts, predominantly adverse, will result both directly from altered climatic conditions (e.g. more severe heat waves and more frequent extreme weather events) and from the diverse environmental, ecological, economic and social impacts of climate change (5).

Indigenous peoples live in closer contact with nature than others and have valuable knowledge of ongoing biophysical and ecological processes. They have also, as the legacy of a long-standing nomadic lifestyle, both an adaptive capacity and knowledge of adaptation strategies that can be of great value for the wider, more urbanised, population.

In this special issue of *Global Health Action*, contributions from researchers from all over the Arctic address different aspects of these climatic and environmental

changes, with a focus on how they affect human health. We can also read about insights and opportunities. Indigenous peoples have been interviewed about what they have recently observed in nature, and their conclusions from these observations. They provide insights into how important their cultural identity and social context are for their continued well-being. They have also been asked how these factors influence their choices about moving or not.

There is no doubt that both the everyday life and health status of many indigenous groups are already undergoing rapid change, some of them because of climate change. This includes a higher level of mental ill-health and the health consequences of a change of diet to a more western way of eating (including a much higher intake of processed foods), causing overweight, type 2 diabetes and an increase in cardiovascular diseases. Reports of research and intervention programmes among indigenous groups in Alaska describe that risks of injury, mental stress and non-communicable diseases are increasing. Mortality rates for Alaska Natives exceed that of 'all races' in the USA.

Interviews with reindeer herders among the Swedish Sami indicate that they are approaching the limit of resilience. Thinner ice on rivers and lakes increases risks for injuries and losses of animals, as do extreme and unpredictable weather and altered seasons. 'Everything has been regeared' with longer, wetter and warmer autumns, warmer winters and spring coming suddenly and earlier than before changing the traditional type of herding and making it more difficult to migrate the herds. The tree line is rising and the vegetation is changing, resulting in a shrinking of grazing lands.

Other businesses, including wind power, hydropower, forestry and mining, are increasingly competing for traditional indigenous pastoral space. All this threatens the sustainability of a traditional life style, including reindeer herding. The resultant sense of grief and loss of control threaten the identity of the Sami. On the other hand, the interviewed herders also speak about the long-tested adaptive capacity and of opportunities. Yet, even so, the feeling of constantly being 'left out in the cold' by authorities persists in their answers.

Other research presented here shows that various animals, including mammals, insects and parasites, are moving their habitats in response to climate change. This, in turn, makes it possible for microorganisms to expand their territories. Hunters in northern Sweden, for example, have noticed that their dogs are being infested by more ticks, year by year. Researchers from Russia describe, for example, a recent 50-fold increase in the prevalence of tick-borne encephalitis (TBE) in the northwestern part of the

country. In Sweden, the number of human cases of tularaemia has increased in the north recently, and TBE is now also occurring over a widened region in southern Sweden. Effective surveillance of these changes in the range and seasonality of various infectious diseases, and their health consequences, is needed to minimise future risks for humans and animals.

Environmental risks to health from chemical contaminants in the environment have been of particular concern in the Arctic, due to long-range transportation (atmospheric and ocean transport) from lower latitudes as well as from local sources. Examples of such contaminants are persistent toxic substances, including mercury and lead, and persistent organic pollutants such as polychlorinated biphenyls and pesticides. These hazardous chemicals are of particular concern for the unborn. Surveillance of contaminants in the environment and in food and water has been ongoing for some years, and some encouraging evidence is presented here showing that, consequently, situations can sometimes improve.

Times of change, as we now experience with climate change, present not only more problems but also more opportunities – especially opportunities to change, even transform, methods of production, consumption and energy generation and use. However, without well-functioning surveillance systems for different health aspects and without adequate research and appropriate research funding, the problems will overwhelm the opportunities.

Food security is a central concern – and an important example. Food security requires that all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active healthy life. However, with the advent of climate change, climatic conditions and seasonal timetables will change in ways that affect food yields. Other more specific problems will result. For example, underground ice cellars traditionally used to store whale meat frozen all year round no longer function safely due to thawing of the permafrost. Such climate-related changes in long-standing customs and ways of living ultimately lead to stress, mental disorders and suicides.

Water security means having access to water of good quality. Without access to food and water of good quality, health is threatened and living conditions are impaired. Data reported in this issue show that, in Alaska in areas with declining access to water, there is an increase in respiratory and skin infections resulting in more cases of hospitalisation. A surveillance of the quality of food and water, and of access to them, is of particular importance in the Arctic, especially now that, in addition to longer standing and more localised environmental problems, the climate is changing so rapidly (6).

The Arctic Council has a number of working groups, and the Sustainable Development Working Group (SDWG) has recently formed an expert group on human

health together with representatives of the indigenous peoples in the north. The Arctic Human Health Expert Group (AHHEG) is responsible for framing the SDWG human health agenda, proposing priorities and projects, and assessing proposals for actions that will contribute to the advancement of a knowledge base on circumpolar human health.

This special issue is an initiative from the AHHEG to raise awareness and knowledge of the effects of ongoing climate change on the health of humans in the Arctic and adjoining north. The rest of the world should question whether it is reasonable that some human groups and their cultures should pay so high a price for activities performed by populations elsewhere – including, now especially, activities that contribute to climate change. Indigenous peoples are the most vulnerable humans in this context, but further, all humans and animals in the north are exposed to these climatic and environmental changes. Ethical perspectives must, therefore, be brought to the conference table as well as into academic environments. The media's awareness of the significance and urgency of this great modern threat and challenge should also increase thereby contributing to wider public understanding of the need for action.

Further research on the effects of climate change on human and animal health and activities in the north will provide essential knowledge. This requires more funding for scientific research, the result of which will be more secure data for decision makers to shape the best possible future for a planet on which the conditions for life are ever changing, albeit now much more rapidly than when nature acts alone.

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